

## DEPARTMENTAL RESOURCES

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### CONTACT INFORMATION:

Address: 32 Pearson Hall, Oxford, OH 45056      Phone: (513) 529-5422  
Web: <http://www.cas.muohio.edu/micro/>      FAX: (513) 529-2431  
Email: [microbiology@muohio.edu](mailto:microbiology@muohio.edu)

### ABOUT THE DEPARTMENT

The Department of Microbiology, established in 1956 in the College of Arts and Science, offers Bachelor of Arts, Master of Science, and Doctor of Philosophy degrees in Microbiology. The Bachelor of Science in Clinical Laboratory Science is also administered within the department. The department is composed of 12 faculty members, 4 postdoctoral fellows, 25 graduate students, approximately 300 undergraduate majors, and a professional support staff. The group occupies modern research and teaching facilities in Pearson Hall. Departmental research interests include immunology, molecular biology, microbial ecology, microbial genetics, microbial physiology, pathogenic microbiology, medical mycology, and virology.

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## DEPARTMENTAL RESOURCES

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### FACULTY

Faculty	Office	Lab	Email
Dr. K. Abshire	66		abshirk@muohio.edu
Dr. L. A. Actis, Chair	32	41F	actisla@muohio.edu
Dr. M. F. Balish	80	79	balishmf@muohio.edu
Dr. R. S. Balish	37		balishrs@muohio.edu
Dr. A. Bollmann	46	3	bollmaa@muohio.edu
Dr. E. Bridge	54	53A	bridgee@muohio.edu
Dr. J. M. Carlin	48	53F	carlinjm@muohio.edu
Dr. X-W. Cheng	56	71	chengx@muohio.edu
Dr. K. Cowan			cowanmm@muohio.edu
Dr. D.J. Ferguson	53P	53B	fergusdj@muohio.edu
Dr. I. Friedberg	164		i.friedberg@muohio.edu
Dr. G. R Janssen	68	70	janssegr@muohio.edu
Dr. M. R. Lee	42	41C	leemr@muohio.edu
Dr. R. Morgan-Kiss	44	53G	morganr2@muohio.edu
Dr. D. Phillips	37		phillidj@muohio.edu
Dr. J. R. Stevenson	52	53F	stevenjr@muohio.edu
Dr. M. E. Woodworth	58		woodwome@muohio.edu

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For more information, please contact Dr. Luis Actis, Chair of the Department, 529-5422, email: ActisLA@MUOhio.edu. You are also encouraged to visit our website:

<http://www.cas.muohio.edu/micro/>

### UNDERGRADUATE ADVISING

First-year undergraduates are assigned faculty advisors during the second semester. You may request an appointment with your advisor on the web at <http://www.cas.muohio.edu/micro/undergrad/advising.html>, by email, by phone, or in person. In addition, the name of your academic advisor and their contact information can be found on your myMiami website "Student" tab.

### UNDERGRADUATE RESEARCH

Get the most out of your undergraduate microbiology training by getting involved in undergraduate research. Many Miami undergrads participate in research programs in Microbiology; this research can meet some of the requirements for the Microbiology Capstone. Contact our faculty with research programs that interest you to explore the possibilities.

## MAJORING IN MICROBIOLOGY

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To provide a more comprehensive view of the Microbiology major, this pamphlet combines the Miami Plan, College, and Department requirements into one document, and indicates the semester schedules taken by most of our students to complete these requirements. The required and recommended courses in science are specifically noted because many of them must be taken in sequence, and some of them may be offered only once a year. To fulfill the Miami Plan requirements (MPF) and college requirements (CAS) you will take a certain number of credit hours from several categories of courses. The program is designed to:

- 1) provide a balanced background for the modern microbiologist, and
- 2) permit additional study in the area of your special interest.

Progress towards fulfillment of the requirements for the A.B. degree in Microbiology is provided online for each student (and their advisor) through their Degree Audit Reporting System (DARS).

### WHAT IS MICROBIOLOGY?

Microbiology begins with the study of bacteria, yeasts, molds, viruses, and plasmids - the microbes; how they are isolated, cultivated, and identified. The next level of study considers them as individual living systems, their physiology and genetics. The third level of study, the working level of a modern microbiologist, is concerned with how microbes interact with living and non-living things and how these interactions may be controlled, modified, or expanded. Microbiology is a field whose challenges range from understanding mechanisms of infectious disease to utilizing microorganisms to clean up an environmentally devastating oil spill; from applying biotechnology to produce human insulin in bacterial cells to manipulating bacterial genes for improving agricultural crops and livestock; from stimulating our immune rejection of tumor cells to replacing hazardous chemicals with insecticidal viruses.

### COURSE SELECTION AND REQUIREMENTS FOR THE MICROBIOLOGY MAJOR

Students are urged to continue developing the foreign language study started in high school. If prepared, you may wish to take a first year sequence of 101 and 102, **or** 201 and 202, **or** a course at the 300 level, rather than the two-year sequence indicated on the next page. All MBI students must pass 202.

Ask your advisor how certain elective courses may contribute to your particular professional goals. Some students will devote their elective course hours to obtain a second major, e.g., in Chemistry or Spanish; other students may use these hours for additional preparation for professional school standardized tests.

The requirements for graduation represent the faculty's consolidation of the specifics indicated by prospective employers and feedback from graduates into what is reasonable for a good, average student in our baccalaureate program. The program is intentionally broad in focus within the discipline in order to expand the opportunities of the graduate. Recent changes in the curriculum provide for a set of core courses needed by all microbiology majors, focus courses that provide more in-depth coverage of disciplines within the field, and elective courses to complement the students' career objectives.

Your requirements for the degree are governed by the year of your admission to Miami University. Since the department recently revised the curriculum, there are two sets of course requirements for the A.B. degree in Microbiology, one set for students admitted to Miami University prior to 2008, and another for students admitted beginning in 2008. Students who enrolled prior to 2008 may elect to change to the latest catalog year by filling out a "Change of Major" form in the Microbiology office.

For more information, please contact Dr. Luis Actis, Chair of the Department, 529-5422, email: ActisLA@MUOhio.edu. You are also encouraged to visit our website:

**<http://www.cas.muohio.edu/micro/>**

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**COURSE REQUIREMENTS FOR A.B. DEGREE IN MICROBIOLOGY**  
**Admission prior to 2008**

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**First Year**

<i>Fall Semester</i>		<i>Spring Semester</i>	
General Chemistry: CHM 141, 144	3+2	General Chemistry: CHM 142, 145	3+2
Biological Concepts: MBI 115	4	Biological Concepts: MBI 116	4
Composition and Literature: ENG 111	3	Composition and Literature: ENG 112	3
Foreign Language: 101	4	Foreign Language: 102	4

**Second Year**

<i>Fall Semester</i>		<i>Spring Semester</i>	
General Microbiology: MBI 201	4	General Microbiology: MBI 202	4
Organic Chemistry: CHM 231 or CHM 241/244	4/5	Biochemistry: CHM 332 or CHM 242/245	4/5
Calculus: MTH 151 or Statistics: STA 261	5/4	Miami Plan/CAS Requirements/Electives	4-6
Foreign Language: 201	3	Foreign Language: 202	3

**Third Year**

<i>Fall Semester</i>		<i>Spring Semester</i>	
Microbial Genetics: MBI 445	3	Molecular and Cellular Biology: MBI 365	3
Microbial Physiology: MBI 425	4	Pathogenic Microbiology: MBI 405	4
Physics: PHY 171 (or 181), 183	3(4)+1	Physics: PHY 172 (or 182), 184	3(4)+1
Miami Plan/CAS Requirements/Electives	4	Miami Plan/CAS Requirements/Electives	4

**Fourth Year**

<i>Fall Semester</i>		<i>Spring Semester</i>	
Immunology Principles and Practice: MBI 415	4	Human Viruses: MBI 464	3
Microbiology Elective courses*	2-3	Microbiology Elective courses*	2-3
Miami Plan/CAS Requirements/Electives	9-10	Miami Plan/CAS Requirements/Electives	9-10
<i>Fall or Spring Semester</i>			
Senior Seminar: MBI 490: in either Fall or Spring semester during the senior year			1

**\* Microbiology Elective Courses**

<i>Fall Semester</i>		<i>Spring Semester</i>	
Intro to Clinical Laboratory Sciences: MBI 143	1	Molecular Genetics Laboratory: MBI 465	2
Medical Mycology: MBI 435 <sup>†</sup>	3	Microbial Ecology: MBI 475 <sup>††</sup>	3
		Principles of Bioinformatics: MBI 485	3
		Bacterial Cell Biology: MBI 495	3
<i>Fall or Spring Semester</i>			
Epidemiology: MBI 361 <sup>†††</sup>			3
Research Problems: MBI 440			2-4
Independent Study: MBI 477			2-4
Departmental Honors: MBI 480			1-6

<sup>†</sup> Usually offered in even-numbered years only

<sup>††</sup> Usually offered in odd-numbered years only

<sup>†††</sup> Fall - Middletown Campus (every year), Oxford campus (odd-numbered years); Spring and Summer - Hamilton Campus

**COURSE REQUIREMENTS FOR A.B. DEGREE IN MICROBIOLOGY**  
**Admission prior to 2008**

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**Requirements for the A.B. degree in Microbiology (32 hours):**

Major courses, 32 hours:

- General Microbiology I and II; Pathogenic Microbiology; Immunology; Microbial Physiology; Human Viruses, Microbial Genetics or Molecular Biology; Senior Seminar.
- Microbiology electives

Related science courses, 32-37 hours:

- Biological Concepts, Calculus or Statistics, General Chemistry with Lab, Organic Chemistry with Lab, Biochemistry, Physics with Lab

*NOTE: MBI 440, 440.C, 477, 477.C, 480, 480.C have a maximum of 4 credits that can be counted as electives.*

*NOTE: No Microbiology or required related course may be taken on credit/no credit basis.*

*MBI 115, 116, 175, 275, 402, and 424 DO NOT COUNT towards the 32 required hours in Microbiology.*

**Thematic Sequence:**

Students may choose from among any of the thematic sequences offered at Miami University. Students must register for the thematic sequence at the department offering the sequence.

*NOTE: Microbiology majors cannot use a Microbiology thematic sequence to satisfy the requirement.*

**Capstone in Microbiology:**

Microbiology Capstone (3): see <http://www.cas.muohio.edu/micro/curriculum/capstone.html> for detailed description

- Library Research 440.C (2) + Senior Seminar 490.C (1)

-or-

- Laboratory Research 477.C (2) + Senior Seminar 490.C (1)

*NOTE: You must use the .C modifier for all courses within the Microbiology Capstone for capstone credit.*

*NOTE: Research Capstone and Seminar Capstone courses require a completed independent study form and a completed force add form, respectively.*

*NOTE: Microbiology majors can satisfy capstone requirements with any capstone offered by Miami University.*

**Courses suggested as non-microbiology electives for A.B. degree in Microbiology:**

Technical Writing: ENG 313 (3); Analytical Chemistry: CHM 363, 364 (3,2); additional upper-level Chemistry; Introductory Computing: CSA 141 (2) with or without CIT 101.D (1)

*NOTE: Student should be competent in computer usage before taking MBI 201.*

**COURSE REQUIREMENTS FOR A.B. DEGREE IN MICROBIOLOGY**  
**Admission beginning in 2008**

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**First Year**

<i>Fall Semester</i>		<i>Spring Semester</i>	
General Chemistry: CHM 141, 144	3+2	General Chemistry: CHM 142, 145	3+2
Biological Concepts: MBI 115	4	Biological Concepts: MBI 116	4
Composition and Literature: ENG 111	3	Composition and Literature: ENG 112	3
Foreign Language: 101	4	Foreign Language: 102	4

**Second Year**

<i>Fall Semester</i>		<i>Spring Semester</i>	
General Microbiology: MBI 201	4	General Microbiology: MBI 202	4
Organic Chemistry: CHM 231 or CHM 241/244	4/5	Biochemistry: CHM 332 or CHM 242/245	4/5
Calculus: MTH 151 or Statistics: STA 261	5/4	Miami Plan/CAS Requirements/Electives	4-6
Foreign Language: 201	3	Foreign Language: 202	3

**Third Year**

<i>Fall Semester</i>		<i>Spring Semester</i>	
Microbial Genetics: MBI 445	3	Molecular and Cellular Biology: MBI 365	3
Microbial Physiology: MBI 425	4	Microbiology Focus/Elective courses*	3-4
Physics: PHY 171 (or 181), 183	3 (4)+1	Physics: PHY 172 (or 182), 184	3(4)+1
Miami Plan/CAS Requirements/Electives	4	Miami Plan/CAS Requirements/Electives	4

**Fourth Year**

<i>Fall Semester</i>		<i>Spring Semester</i>	
Microbiology Focus/Elective courses*	5-7	Microbiology Focus/Elective courses*	5-6
Miami Plan/CAS Requirements/Electives	9-11	Miami Plan/CAS Requirements/Electives	9-10
<i>Fall or Spring Semester</i>			
Senior Seminar: MBI 490: in either Fall or Spring semester during the senior year			1

**\* Microbiology Focus Courses**

<i>Fall Semester</i>		<i>Spring Semester</i>	
Immunology Principles and Practice: MBI 415	4	Pathogenic Microbiology: MBI 405	4
or Immunology Principles: MBI 414	3	Human Viruses: MBI 464	3
Medical Mycology: MBI 435 <sup>†</sup>	3	Molecular Genetics Laboratory: MBI 465	2
		Microbial Ecology: MBI 475 <sup>††</sup>	3
		Principles of Bioinformatics: MBI 485	3
		Bacterial Cell Biology: MBI 495	3

**\* Microbiology Elective Courses**

<i>Fall Semester</i>		<i>Spring Semester</i>	
Geomicrobiology: MBI 402 <sup>†</sup>	3		
Biological Instrumentation: MBI 424 <sup>†</sup>	3		
Bioinformatics Computing Skills: MBI 466	3		
<i>Fall or Spring Semester</i>			
Epidemiology: MBI 361 <sup>†††</sup>			3
Research Problems: MBI 440: in either Fall, Spring or Summer semester during the senior year			2-4
Independent Study: MBI 477: in either Fall, Spring or Summer semester during the senior year			2-4
Departmental Honors: MBI 480: in either Fall, Spring or Summer semester during the senior year			1-6

<sup>†</sup> Usually offered in even-numbered years only

<sup>††</sup> Usually offered in odd-numbered years only

<sup>†††</sup> Fall - Middletown Campus (every year), Oxford campus (odd-numbered years); Spring and Summer - Hamilton Campus

**COURSE REQUIREMENTS FOR A.B. DEGREE IN MICROBIOLOGY**  
**Admission beginning in 2008**

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**Requirements for the A.B. degree in Microbiology (32 hours):**

Core Courses, 19 hours:

- General Microbiology I and II, Microbial Genetics, Molecular and Cellular Biology, Microbial Physiology; Senior Seminar.

Focus Courses, 9 hours minimum (must include at least 2 credit hours of lab):

- Lab component:  
Pathogenic Microbiology; Immunology; Medical Mycology; Molecular Genetics Laboratory (2 hr)
- No lab component:  
Human Viruses; Microbial Ecology; Principles of Bioinformatics; Bacterial Cell Biology

Elective Courses:

- Additional MBI Focus and Elective Courses

*NOTE: MBI 440, 440.C, 477, 477.C, 480, 480.C have a maximum of 4 credits that can be counted as electives.*

Related science courses, 27-32 hours:

- Biological Concepts I and II, Calculus or Statistics, General Chemistry with Lab, Organic Chemistry with Lab, Biochemistry, Physics with Lab.

*NOTE: No Microbiology or required related course may be taken on credit/no credit basis.*

*MBI 100-level courses and MBI 275 DO NOT COUNT towards the 32 required hours in Microbiology.*

**Thematic Sequence:**

Students may choose from among any of the thematic sequences offered at Miami University. Students must register for the thematic sequence at the department offering the sequence.

*NOTE: Microbiology majors cannot use a Microbiology thematic sequence to satisfy the requirement.*

**Capstone in Microbiology:**

Microbiology Capstone (3): see <http://www.cas.muohio.edu/micro/curriculum/capstone.html> for detailed description

- Library Research 440.C (2) + Senior Seminar 490.C (1)
- or-
- Laboratory Research 477.C (2) + Senior Seminar 490.C (1)

*NOTE: You must use the .C modifier for all courses within the Microbiology Capstone for capstone credit.*

*NOTE: Research Capstone and Seminar Capstone courses require a completed independent study form and a completed force add form, respectively.*

*NOTE: Microbiology majors can satisfy capstone requirements with any capstone offered by Miami University.*

**Courses suggested as non-microbiology electives for A.B. degree in Microbiology:**

Technical Writing: ENG 313 (3); Analytical Chemistry: CHM 363, 364 (3,2); additional upper-level Chemistry; Introductory Computing: CSA 141 (2) with or without CIT 101.D (1)

*NOTE: Student should be competent in computer usage before taking MBI 201.*

## MINOR IN MOLECULAR BIOLOGY

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This minor is offered cooperatively by the Departments of Botany, Chemistry and Biochemistry, Microbiology, and Zoology. This minor enables students to pursue in depth a multidisciplinary study of biological phenomena at the molecular level. It provides a strong foundation for students planning careers in biotechnology industries or advanced work at the graduate level. For more information on the Molecular Biology Minor, contact Dr. Luis Actis, 529-5422, email: ActisLA@MUOhio.edu.

### Program Requirements (18 semester hours)

#### Grade Point Average

- A minimum of 2.0 grade point average is required for all courses in the minor.
- Students must complete a request form in the College of Arts and Science Advising Office in order to get a transcript notation for the minor.

#### Three of these:

- One course in biochemistry (CHM 332, CHM 432, or CHM 433);
- One course in cell biology (BOT 203, MBI 201, ZOO 203, or ZOO 443);
- One course in molecular biology (CHM 434; MBI 365 or ZOO 444);
- At least one course must be taken from each of three of the four departments.

#### Laboratory requirement:

- One laboratory course (BOT 415, CHM 438, MBI 465, or ZOO 464), or
- Earn at least two credits of departmentally approved directed research in molecular biology

**NOTE:** see your departmental Molecular Biology Minor advisor: students doing directed research in molecular biology should have their proposed research experience evaluated by their departmental representative at the time they initiate their research and must have formal approval from their departmental representative at least one semester prior to graduation

Other courses to bring the total number of semester hours to 18 may be chosen from among the following:

BMZ 424	Biological Instrumentation	4	MBI 425	Microbial Physiology	4
BOT 203	Introduction to Plant Cell & Molecular Biology	4	MBI 445	Microbial Genetics	3
BOT 255	Plant Biotechnology	3	MBI 464	Human Viruses	3
BOT 342	Genetics	3	MBI 465	Microbial and Molecular Genetics Laboratory	2
BOT 403	Plant Development	3	ZOO 202	Developmental Biology	4
BOT 415	Plant Tissue Culture/Plant Biotech Laboratory	4	ZOO 203	Introduction to Cell Biology	3
CHM 332	Outlines of Biochemistry	4	ZOO 342	Genetics	3
CHM 432	Fundamentals of Biochemistry	4	ZOO 442	Mechanisms of Animal Development	3
CHM 433	Biochemistry	3	ZOO 443	Cell Biology	3
CHM 434	Biochemistry	3	ZOO 444	Molecular Biology	3
CHM 438	Biochemistry Laboratory	2	ZOO 449	Biology of Cancer	3
MBI 201	General Microbiology	4	ZOO 464	Laboratory in Cell and Molecular Biology	3
MBI 365	Molecular and Cellular Biology	3	ZOO 471	Molecular Physiology	3
MBI 414/5	Immunology Principles/Practice	3			

**NOTE:** Any individual course can be used to fulfill minor requirements and major requirements except that cross-listed courses cannot count as an out of department course for the minor and for the major (e.g. BOT/ZOO342).

### Minor in Molecular Biology Steering Committee:

David Pennock, Department of Zoology, Chair  
Luis Actis, Microbiology  
Christopher Makaroff, Chemistry & Biochemistry  
Quinn Li, Botany

## MAJORING IN CLINICAL LABORATORY SCIENCE

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To provide a more comprehensive view of the Clinical Laboratory Science major, we have combined the Miami Plan, College, and Department requirements into one document (available in Room 32 Pearson Hall, or for download), which indicates the semester schedules taken by most of our students to complete these requirements. The required and recommended courses in science are specifically noted because many of them must be taken in sequence, and some of them may be offered only once a year. To fulfill the Miami Plan requirements (MPF) and college requirements (CAS) you will take a certain number of credit hours from several categories of courses. Progress towards fulfillment of the requirements for the B.S. degree in Clinical Laboratory Science is provided online for each student (and their advisor) through their Degree Audit Reporting System (DARS).

### WHAT IS CLINICAL LABORATORY SCIENCE?

Clinical laboratory science is a major comprised of five specialties: Clinical Chemistry, Hematology, Microbiology, Immunohematology, and Immunology. Clinical laboratory scientists apply scientific background and skills to the supervision and performance of an ever-broadening range of complex laboratory diagnostic and research activities. The lives and health of patients often depend on specialized tests performed by clinical laboratory scientists. Examples of these procedures include biochemical tests for cardiac enzymes, detection of abnormal blood cells in a stained blood smear, and microscopic identification of parasitic protozoa, which may provide the earliest clues to respective diagnoses of heart attack (myocardial infarction), leukemia, and giardiasis.

Clinical laboratory scientists play a major role as team members to provide the best health care. These individuals contribute their expertise in public health laboratories, research laboratories, and forensic laboratories. In addition to laboratory work, clinical laboratory scientists frequently perform administrative duties, supervise laboratory departments and become instructors in educational programs.

### COURSE SELECTION AND REQUIREMENTS FOR THE CLINICAL LABORATORY SCIENCE MAJOR

The B.S. in Clinical Laboratory Science may be earned by following a "combined program," which includes a one year clinical laboratory internship at a Miami University-affiliated hospital, following either three or four years of pre-internship study at Miami. The B.S. in Clinical Laboratory Science must include a total of 134 semester hours, comprised of 96 pre-internship and 38 internship hours program, as indicated, with a fourth year internship at one of the teaching hospitals affiliated with the program. (See most recent catalog.)

These internships are awarded at the sole discretion of the hospital's Admissions Committee. Admission is based upon curriculum, performance and personal interview. Miami University establishes the requirements of the three academic years for students who wish to compete for these internships, and will award the degree upon successful completion of the fourth year.

Students may also elect to earn an A.B. in Microbiology first, then apply for admission to **any** ASCP accredited teaching hospital to fulfill the internship requirement of the National Registry program.

For more complete details of these and other options within this area, you are urged to contact, early and frequently, the Clinical Laboratory Science Program Director, Dr. Marcia Lee. Current policies regarding requirements, applications, petitions, etc., are available only through her office, 42 Pearson Hall, Department of Microbiology, 529-5425.

**COURSE REQUIREMENTS FOR B.S. DEGREE  
IN CLINICAL LABORATORY SCIENCE**

**First Year**

<i>Fall Semester</i>		<i>Spring Semester</i>	
General Chemistry: CHM 141, 144	3+2	General Chemistry: CHM 142, 145	3+2
Biological Concepts: MBI 115	4	Biological Concepts: MBI 116	4
Composition and Literature: ENG 111	3	Composition and Literature: ENG 112	3
Foreign Language: 101	4	Foreign Language: 102	4

**Second Year**

<i>Fall Semester</i>		<i>Spring Semester</i>	
General Microbiology: MBI 201	4	General Microbiology: MBI 202	4
Organic Chemistry: CHM 231 or CHM 241/244	4/5	Biochemistry: CHM 332 or CHM 242/245	4/5
Calculus: MTH 104, 151 or Statistics: STA 261	5/5/4	Miami Plan/CAS Requirements/Electives	4-6
Foreign Language: 201	3	Foreign Language: 202	3

**Third Year**

<i>Fall Semester</i>		<i>Spring Semester</i>	
Immunology Principles and Practice: MBI 415	4	Pathogenic Microbiology: MBI 405	4
Miami Plan/CAS Requirements/Electives	6-9	Miami Plan/CAS Requirements/Electives	8
Select one of the following electives:		Select one of the following electives:	
Medical Mycology: MBI 435 <sup>†</sup>	3	Human Viruses: MBI 464	3
Physics: PHY 171 (or 181), 183	3 (4)+1	Parasitology: ZOO 405	4
		Analytical Chemistry: CHM 363/364	3+2

**Fourth Year**

<i>Fall Semester</i>		<i>Spring Semester</i>	
Clinical Laboratory Science Practicum: MBI 487	8	Clinical Laboratory Science Practicum: MBI 489	12
Clinical Laboratory Science Practicum: MBI 488	12		

**\* Microbiology Elective Courses**

<i>Fall Semester</i>		<i>Spring Semester</i>	
Intro to Clinical Laboratory Sciences: MBI 143	1	Molecular Genetics Laboratory: MBI 465	2
Medical Mycology: MBI 435 <sup>†</sup>	3	Departmental Honors: MBI 480	1-6
Independent Study: MBI 477	2-4	Senior Seminar: MBI 490	1
Research Problems: MBI 440	2-4		

<sup>†</sup> Usually offered in even-numbered years only

**Courses for the B.S. in Clinical Laboratory Sciences must include:**

Required science courses, 80-82 hours:

- Biological Concepts (4,4) or Animal Diversity (4) and Principles of Biology (4).
- General Microbiology I and II (4,4); Pathogenic Microbiology (4); Immunology (4).
- Clinical Laboratory Science Practicum (8,12,12)
- College Chemistry (3,3) and College Chemistry Laboratory (2,2); Fundamentals of Organic Chemistry (4) and Outlines of Biochemistry (4) or Organic Chemistry (3,3) and Organic Chemistry Laboratory (2,2)

Related science courses, 13-17 hours:

- Precalculus with Algebra (5) or Calculus (5)
- Introduction to Microcomputers (3)
- At least two of these courses: Analytical Chemistry, CHM 363, 364 (5); Medical Mycology (3); Human Viruses (3); College Physics (4-5); Parasitology (4)

**NOTE: No required course may be taken on credit/no credit basis.**

**Student should be competent in computer usage before taking MBI 201.**

## THE CLINICAL LABORATORY SCIENCE INTERNSHIP

An interdisciplinary blend of classes in chemistry, microbiology and zoology are required for the B.S. in CLS. The required coursework includes a twelve-month, 32-credit (off campus) internship. This internship includes both lecture and laboratory rotations in toxicology, hematology, immunohematology, coagulation, parasitology, pathogenic bacteriology, virology, and clinical chemistry. Miami University is affiliated with 10 hospitals throughout Ohio, Indiana, Kentucky, Tennessee and Florida, providing diverse laboratory experiences for CLS interns. Our clinical laboratory affiliates include University of Cincinnati Hospitals, Southwest General Health Center in Middleburg Heights, Ohio, Wright State University, Children's Hospital Medical Center in Akron, Ohio, Parkview Hospital in Fort Wayne, Indiana, St. Elizabeth Medical Center in Edgewood, Kentucky, University of Louisville, Medical University of South Carolina in Charleston, South Carolina, The Vanderbilt Medical Center in Nashville, Tennessee, and St. Vincent's Medical Center in Jacksonville, Florida.

The preinternship coursework is completed in either 3 or 4 years at Miami University. Thus, a student may be enrolled in the internship either during their senior year, i.e. following three years of pre-internship coursework at Miami, earning a B.S. degree, OR as a fifth year, i.e. following four years of pre-internship coursework at Miami), with the possibility of earning a double major. Upon completion of the internship program, the student takes a national board examination to become a Medical Technologist (MT(ASCP)) or Clinical Laboratory Scientist (CLS(NCA)).

*NOTE: The CLS internship (courses MBI 487, 488, and 489) fulfills the Miami Plan Capstone requirement.*

<b>3 years</b> (96 semester credits)	<b>PLUS</b>	<b>1 year CLS internship</b>	<b>=</b>	<b>B.S. in CLS</b>
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**OR**

<b>4 years</b> (128 semester credits)	<b>PLUS</b>	<b>1 year CLS internship</b>	<b>=</b>	<b>double major</b> (B.A. in Zoology, Chemistry, or Microbiology and a B.S. in CLS)
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**OR**

<b>Either 3 OR 4 years</b>	<b>PLUS</b>	<b>2 year CLS internship</b>	<b>=</b>	<b>B.S. in CLS,</b> <b>M.S. (graduate degree)</b> (upon completion of 2nd year)
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## CAREER AND PROFESSIONAL OPPORTUNITIES

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### DIVERSITY OF CAREER OPPORTUNITIES

A major in microbiology prepares one for a career in almost any field in medicine and biology. Microbiologists work in every sector of the economy: Universities, Colleges, Schools, Hospitals, Government Agencies, Congress, Industry, the Peace Corps, NASA and the Military.

Infectious disease	Patent law	Infection control
Technical sales	Bioremediation	Quality control
Product development	Bioethics	Food technology
Medical illustration	Biotechnology	Molecular biology
Genetic engineering	Education	Vaccine development
Bioremediation	Virology	Microbial genetics
Scientific research	Microbial ecology	Public health
Forensic medicine	Epidemiology	Microbial physiology
Environmental health	Clinical microbiology	Environmental law
Laboratory administration	Pollution control	Agricultural microbiology
Veterinary microbiology	Technical writing	Drug development
Human genome project	Immunology	Biological weapons defense

*NOTE: Some of the options listed may require training beyond the bachelor's degree.*

### GRADUATE AND PROFESSIONAL SCHOOL OPPORTUNITIES

Students may choose to continue their education in microbiology, molecular biology, genetics, biochemistry, immunology, virology, mycology, or clinical microbiology. Many graduates choose to go to professional schools in medicine, dentistry, veterinary medicine, law or business.

### ADMISSION REQUIREMENTS FOR PROFESSIONAL SCHOOLS

The requirements for a major in **Microbiology** are virtually the same as those, which will qualify students to apply to Medical, Dental and Veterinary School. Requirements for entrance to all three professional schools vary somewhat, but the most important courses for each are listed below.

#### MEDICAL SCHOOL

Requirements	Miami Courses
English (1 year)	ENG 111, 112
Biology with lab (1 year)	MBI 115, 116
General or College Chemistry (1 year) with lab	CHM 141, 142 144, 145 or 153, 161
Organic Chemistry (1 year) with lab	CHM 241, 242 or 251, 252 244, 245 or 254, 255
Physics (1 year) with lab	PHY 171, 172 or 181, 182, 183, 184
Math (1 year – statistics highly recommended)	STA 261 MTH 151, other

The Mallory-Wilson Center for Healthcare Education website provides detailed advice for premedical students with the hope of helping Miami students achieve their goal of entering a health profession.

Information about the Mallory Center and the Miami University Premedical Advisory Committee is available at:

<http://www.cas.muohio.edu/mwche/>

## CAREER AND PROFESSIONAL OPPORTUNITIES

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### VETERINARY SCHOOL

The requirements for admission to Veterinary School are less uniform than those for Medical School. Experience in some of the following courses is, however, highly desirable.

Requirements	Miami Courses
English (1 year)	ENG 111, 112
Biology with lab (1 year)	BMZ 115, 116
Microbiology	MBI 201, 202,
Zoology	ZOO 201, 202, 342
General or College Chemistry (1 year)	CHM 141, 142
with lab	144, 145 or 153, 161
Organic Chemistry (1 year)	CHM 241, 242 or 251, 252
with lab	244, 245 or 254, 255
Biochemistry	CHM 332
Physics (1 year)	PHY 171, 172 or 181, 182,
with lab	183, 184
Math (1 semester)	MTH any level

For specific requirements for each medical school you are encouraged to look at the website of the Association of American Veterinary Medical Colleges.

<http://www.aavmc.org/>

### DENTAL SCHOOL

Although requirements for admission differ somewhat from school to school, the following basic requirements are fairly typical:

Requirements	Miami Courses
English (1 year)	ENG 111, 112
Biology with lab (1 year)	MBI 115, 116
General or College Chemistry (1 year)	CHM 141, 142
with lab	144, 145 or 153, 161
Organic Chemistry (1 year)	CHM 241, 242 or 251, 252
with lab	244, 245 or 254, 255
Physics (1 year)	PHY 171, 172 or 181, 182,
with lab	and 183, 184

Other subjects that may be helpful include Anatomy, Genetics, Mathematics, Biochemistry, Physiology and General Microbiology.

### FORENSIC SCIENCE

The field of Forensic Science covers diverse disciplines, ranging from Criminalistics and Jurisprudence to Forensic Pathology and Forensic Odontology. A major in microbiology can help prepare you for a career in Forensic Science or for graduate study in Forensic Science. For example, the minimum requirement for Criminalistics is a bachelor's degree in chemistry, biology, physics, molecular biology, or a related science (i.e. Microbiology or Clinical Lab Science), and in the future, a master's degree may be required. Other Forensic Science disciplines can require medical, dental or engineering degrees.

Many colleges and universities offer degrees and courses in Forensic Science. In deciding whether to get a bachelor's degree in chemistry, biology, microbiology or forensic science, or to pursue a post-graduate degree, consider your career preferences and study the courses offered. At least 24 semester hours of either chemistry or biology is required and math is a must. The title of the degree is often not as important as the courses taken (adapted from the career page at the American Academy of Forensic Sciences).

Additional information on the pre-professional degree requirements and advice on applications can be obtained from Dr. Luis Actis, Chair of the Department, 529-5422, email: ActisLA@MUOhio.edu.

## MICROBIOLOGY CLUB

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The Micro Club is an organization created to promote student interest and development in microbiology, and to advance scientific knowledge through personal associations and the interchange of ideas. The Micro Club is affiliated with the Ohio Branch of the American Society for Microbiology, and membership in the Miami Microbiology Club also makes you a member of the Ohio Branch of the ASM.

### WHO CAN JOIN?

The majority of the club members are undergraduates majoring in Microbiology, Clinical Laboratory Science, or Zoology. However, all majors are welcome provided you maintain a 2.0 cumulative GPA at the University. Graduate students and faculty can become associate members of the club.

### WHEN ARE THE MEETINGS, AND WHERE ARE THEY HELD?

The regular meetings are held once a month. The meetings will be held in a classroom of Pearson Hall. Flyers will be posted in Pearson Hall and in Hughes Laboratories at least one week before each meeting, telling you when and where to meet. The Micro Club's official newsletter *In Vitro* will also be sent out several times a semester with an updated schedule of events.

### WHAT WILL WE DO?

The meetings will cover future events and any other club business needing to be addressed. Other events include speakers from hospitals, clinics, graduate schools, industries, and medical schools. These speakers will discuss current topics and specific opportunities in microbiology and clinical laboratory science. (If you find an interesting topic or person you would like to invite, contact us!) Other activities include picnics at the beginning and end of each year, movie nights, social gatherings, field trips to such places as Eli Lilly Pharmaceuticals, Kettering Cancer Institute, Miller Brewing Company, graduate and medical schools in the surrounding area, and service opportunities such as blood drives, food drives, and teaching elementary students about microbiology at Marshall Elementary.

### ARE THERE ANY DUES IN THIS ORGANIZATION?

Yes. This year, they are \$35 (for the whole year). The breakdown is as follows: \$17 for the student membership in the American Society for Microbiology and a subscription to ASM News, \$10 for a club t-shirt, and \$8 for micro club membership. The \$8 will be used for correspondence materials, flyers for announcements, refreshments after the meetings, and for reimbursing the traveling expenses of speakers. An ASM membership form must be filled out and returned with your dues. You can pick up a form at the first club meeting or in the micro club mailbox in the micro office in 32 Pearson Hall.

You too can get involved next year as an executive board member. The Micro Club is an excellent way to get to know the faculty, graduate students, and your fellow microbiology and clinical laboratory science majors. If you want to get involved, **BE THERE!**

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## Bachelor of Arts in Microbiology Student/Advisor Worksheet

List credit hours for courses taken in the space provided

\_\_\_\_\_ Grade point average (2.0 minimum required):

### Core Courses (19 hours):

*All of these:*

- \_\_\_\_\_ MBI 201 General Microbiology I (4)
- \_\_\_\_\_ MBI 202 General Microbiology II (4)
- \_\_\_\_\_ MBI 365 Molecular and Cellular Biology (3)
- \_\_\_\_\_ MBI 425 Microbial Physiology (4)
- \_\_\_\_\_ MBI 445 Microbial Genetics (3)
- \_\_\_\_\_ MBI 490 Undergraduate Seminar (1)

### Focus Courses (9 hours minimum):

*Lab requirement (2 credit hours of lab):*

*Select at least 2 of these courses:*

- \_\_\_\_\_ MBI 405 Pathogenic Microbiology (4)
- \_\_\_\_\_ MBI 415 Immunology Principles and Practice (4)
- \_\_\_\_\_ MBI 435 Medical Mycology (3)

*or this course:*

- \_\_\_\_\_ MBI 465 Microbial and Molecular Genetics Laboratory (2)

*Additional Focus Courses, including:*

- \_\_\_\_\_ MBI 414 Immunology Principles (3)
- \_\_\_\_\_ MBI 464 Human Viruses (3)
- \_\_\_\_\_ MBI 475 Microbial Ecology (3)
- \_\_\_\_\_ MBI 485 Principles of Bioinformatics (3)
- \_\_\_\_\_ MBI 495 Bacterial Cell Biology (3)

*Total credits in all Focus Courses (9 hour minimum):*

*(Note: Credit not given for both MBI 414 and MBI 415.)*

### Elective Courses:

*Additional courses to complete the 32 required hours:*

- \_\_\_\_\_ MBI 361 Epidemiology (3)
- \_\_\_\_\_ MBI 402 Geomicrobiology (3)
- \_\_\_\_\_ MBI 424 Biological Instrumentation (3)
- \_\_\_\_\_ MBI 440 Research Problems (2)
- \_\_\_\_\_ MBI 466 Bioinformatics Computing Skills (3)
- \_\_\_\_\_ MBI 477 Independent Study (1-4)
- \_\_\_\_\_ MBI 480 Departmental Honors (1-3)

*Total credits in all Elective Courses:*

*(Note: MBI 440, 440.C, 477, 477.C, 480, 480.C have a maximum of 4 credits that can be counted.)*

### Total Credit Hours in Core, Focus and Elective Courses:

*Must total at least 32 hours (related hours do not count towards the total.)*

### Related Hours (19-23 hours):

*Chemistry:*

- \_\_\_\_\_ CHM 231 Fundamentals of Organic Chemistry (4) and  
CHM 332 Outlines of Biochemistry (4) or
- \_\_\_\_\_ CHM 241, 242 Organic Chemistry (3, 3) and  
CHM 244, 245 Organic Chemistry Laboratory (2, 2)

*Math:*

- \_\_\_\_\_ MTH 151 Calculus (5) or  
STA 261 Statistics (3)

*Physics:*

- \_\_\_\_\_ PHY 171, 172 College Physics (3, 3) and  
PHY 183, 184 Introduction to Physics Laboratory (1, 1) or
  - \_\_\_\_\_ PHY 181, 182 The Physical World (3, 3) and  
PHY 183, 184 Introduction to Physics Laboratory (1, 1)
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## Minor in Molecular Biology Student/Advisor Worksheet

1) Required course work (List appropriate information in the space provided)

- \_\_\_\_\_ Grade point average (2.0 minimum required):  
\_\_\_\_\_ Biochemistry (CHM 332, 432 or 433)  
\_\_\_\_\_ Cell Biology (BOT 203, MBI 201, ZOO 203, or ZOO 443)  
\_\_\_\_\_ Molecular Biology (CHM 434; MBI 365 or ZOO 444)  
\_\_\_\_\_ Laboratory Experience  
\_\_\_\_\_ BOT 415, CHM 438, MBI 465, ZOO 464  
**OR**  
\_\_\_\_\_ Two credits of directed research in molecular biology  
Departmental approval of research plan (students doing directed research in molecular biology should have their proposed research experience evaluated by their departmental representative **at the time they initiate their research** and must have formal approval from their departmental representative **at least one semester prior to graduation**).

2) One approved course in each of three of the four departments (List appropriate courses in the space provided)

- |                                    |   |
|------------------------------------|---|
| _____ Botany<br>_____ Microbiology | _____ Chemistry and Biochemistry<br>_____ Zoology |
|------------------------------------|---|

3) Eighteen semester hours of approved courses (Check all that apply and list total hours \_\_\_\_\_):

- |       |            |  |
|-------|------------|--|
| _____ | BMZ 424    | Biological Instrumentation (4)                       |
| _____ | BOT 203:   | Introduction to Plant Cell and Molecular Biology (4) |
| _____ | BOT 255:   | Plant Biotechnology (3)                              |
| _____ | BOT 342:   | Genetics (3)   |
| _____ | BOT 403:   | Plant Development (3)                                |
| _____ | BOT 415:   | Plant Tissue Culture/Plant Biotech Laboratory (4)    |
| _____ | CHM 332:   | Outlines of Biochemistry (4)                         |
| _____ | CHM 432:   | Fundamentals of Biochemistry (4)                     |
| _____ | CHM 433:   | Biochemistry (3)                                     |
| _____ | CHM 434:   | Biochemistry (3)                                     |
| _____ | CHM 438:   | Biochemistry Laboratory (2)                          |
| _____ | MBI 201:   | General Microbiology (4)                             |
| _____ | MBI 365:   | Molecular and Cellular Biology (3)                   |
| _____ | MBI 414/5: | Immunology Principles (and Practice) (3-4)           |
| _____ | MBI 425:   | Microbial Physiology (4)                             |
| _____ | MBI 445:   | Microbial Genetics (3)                               |
| _____ | MBI 464:   | Human Viruses (3)                                    |
| _____ | MBI 465:   | Microbial and Molecular Genetics Laboratory (2)      |
| _____ | ZOO 202:   | Developmental Biology (4)                            |
| _____ | ZOO 203:   | Introduction to Cell Biology (3)                     |
| _____ | ZOO 342:   | Genetics (3)   |
| _____ | ZOO 464:   | Laboratory in Cell and Molecular Biology (3)         |
| _____ | ZOO 442:   | Mechanisms of Animal Development (3)                 |
| _____ | ZOO 443:   | Cell Biology (3)                                     |
| _____ | ZOO 444:   | Molecular Biology (3)                                |
| _____ | ZOO 449:   | Biology of Cancer (3)                                |
| _____ | ZOO 471:   | Molecular Physiology (3)                             |

*Note: Any individual course can be used to fulfill minor requirements and major requirements except that cross-listed courses cannot count as an out of department course for the minor and for the major (e.g. BOT/ZOO342).*

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